REMARKS

Claims 1-18 were pending in the present application. Claim 1 is objected to for various informalities. Claim 11 is rejected under 35 U.S.C. § 112 as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 15 is rejected under 35 U.S.C. § 112 as failing to comply with the written description requirement. Claims 1-14 and 16-18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Roggero et al. (U.S. 6,662,109 B2, Dec. 9, 2003) in view of Wright et al. (US 2003/0205375 A1, Nov. 6, 2003). Claim 15 is rejected under 35 U.S.C. § 103(a) as being unpatentable over *Roggero* in view of *Wright* and Choe et al. (US 2003/0139916 A1, July 24, 2003). Claims 1, 8, 11, and 15 have been amended, claim 14 has been canceled. Claims 1-13, and 15-18 are pending.

Response to Claim Objections

Objection of Claim 1 for informalities

Claim 1 is rejected for various informalities listed in the *Office Action* page 3. The requested corrections are submitted in Claim 1 as amended, and reconsideration is requested.

Response to Claim Rejections

Rejection of Claim 11 under 35 U.S.C. § 112, second paragraph

Claim 11 is rejected as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention in the *Office Action* page 3. The Examiner proposed correction is submitted in Claim 11 as amended. Reconsideration is requested.

Rejection of claim 15 under 35 U.S.C. § 112, first paragraph

Dependent claim 15 is rejected under 35 U.S.C. § 112 "as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention." *Office Action*, page 4. The *Office Action* continues, "(Claim 15): Recites the limitation 'turbulent gas flow' and the Applicant directed Examiner to Paragraph 0027 of the specification specifically 'compensation for the gases flowing in the fracture.' The Examiner has reviewed Paragraph 0027 and has failed to find support for the term 'turbulent.'" *Office Action*, page 4.

Applicants respectfully assert that the *Office Action* has not fully considered the Applicant's position. The prior Applicant response directed the Examiner to Paragraph 0027 because Paragraph 0027 includes accounting for *non-Darcy factors* (emphasis added). Applicants assert that the term non-Darcy is well accepted in the art as prominently including the concept that flow is in the turbulent rather than laminar region. For example, the Schlumberger online dictionary[1] of oilfield terms provides the following definition for "non-Darcy": "Fluid flow that deviates from Darcy's law, which assumes laminar flow in the formation. Non-Darcy flow is typically observed in high-rate gas wells when the flow converging to the wellbore reaches flow velocities exceeding the Reynolds number for laminar or Darcy flow, and results in turbulent flow. Since most of the turbulent flow takes place near the wellbore in producing formations, the effect of non-Darcy flow is a rate-dependent skin effect."

[1] Found at http://www.glossary.oilfield.slb.com/Display.cfm?Term=non-Darcy%20flow, last visited April 15, 2008. The reference is provided by the Assignee of the present application, but it is a well accepted reference that was established independently of, and prior to, the filing of the present application. The definition is provided in the entirety from the reference.

Further, the inclusion of turbulence in the concept of "non-Darcy" is long-standing. For example, a 1962 paper states "Analysis of data in this fashion is demonstrated to give direct 'in situ' information for reservoir permeability, porosity and *turbulence or non-Darcy coefficient*." *The Prediction of Gas-Well Performance Including the Effect of Non-Darcy Flow*, J. OF PETR. TECH., July 1962, Abstract at page 791, emphasis added. Further, "[i]n practice, the effect of non-Darcy flow is said to be shown by the numerical value of n, the exponent of Eq. 1. by analogy, if n = 1.0, flow is in accordance with Darcy's law; if n = 0.5, flow is turbulent (non-Darcy) throughout the drainage area." *Id.*, at 792. Therefore, Applicants respectfully assert that the inclusion of "non-Darcy factors," such as in original Paragraph 0027, is understood to those of skill in the art to include turbulence and therefore the rejection of Claim 15 under 35 U.S.C. § 112 is improper.

Rejection of claim 8 under 35 U.S.C. § 103(a)

Applicants note for the convenience of the Examiner that independent claim 8 as amended includes the elements of previously presented claim 14. The *Office Action* rejects Claim 14 with *Roggero* in view of *Wright*, stating, "*Wright* et al. teaches, 'the method further comprising introducing non-Darcy factors into the base model.' [The tiltmeter provides fracture width and height (Paragraph 0200)]." *Office Action* page 12. "It is well settled that "[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Further, "[t]he identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). *See also*

MPEP 2131. Applicants respectfully assert that *Roggero* does not disclose the element "producing a performance prediction from the base model, and introducing non-Darcy factors into the base model" as recited in claim 8 as amended.

Applicants respectfully assert that fracture width and height are not elements related to basic assumptions of Darcy's law, and therefore fracture width and height are not subject to being either "Darcy" or "non-Darcy." Stated differently, there are no values of fracture height and width that can be described as meeting or not meeting assumptions of Darcy's law. By contrast, for example, Darcy's law assumes laminar flow, so a given level of turbulence can be described as meeting (i.e. "Darcy") or not meeting (i.e. "non-Darcy") assumptions of Darcy's law. Therefore, Applicant's assert that each element of claim 8 as amended is not found within *Roggero* in view of *Wright*, and therefore the prima facie case to reject claim 8 under 35 U.S.C. § 103(a) has not been presented. Applicants submit that claim 8 as amended is in a condition for allowance.

Rejection of claim 15 under 35 U.S.C. § 103(a)

The *Office Action* rejects dependent claim 15 citing *Roggero* in view of *Wright* and *Choe*, stating:

> (Claim 15): In further view of Claim 14, *Roggero* et al. teaches, that the production data includes the gas-to-oil ratio (Column 8, Lines 60-63). However, *Roggero* et al. fails to explicitly teach, "wherein the non-Darcy factors comprise compensation for turbulent gas flow in a fracture.
>
> *Choe* et al. teaches the application of calculation for simulation both the laminar and turbulent gas flows using equations in the art such as Fanning's equation for laminar flow regions or Newtonian, Bingham plastic, and Power-law equations in turbulent regimes.

> It would have been obvious to combine *Roggero* et al., *Wright* et al., and *Choe* et al. to generate a more accurate base model of the oil/gas field. By combining *Roggero* and *Wright* with *Choe* allows for the turbulent gas flow within oil/gas field to be modeled.
>
> *Roggero*, *Wright*, and *Choe* are analogous art in that they all deal with hydrocarbon well modeling and stimulation.

Office Action, pages 13-14.

Applicants respectfully submit that *Roggero* in view of *Wright* and *Choe* does not disclose "non-Darcy factors compris[ing] compensation for turbulent gas flow in a fracture" as stated in claim 15. Applicants further submit that *Choe* is non-analogous art, and cannot be combined with *Roggero* and *Wright* as suggested in the *Office Action*.

The *Choe* model estimates friction losses for a drilling mud circulating in a wellbore. *See Choe*, paragraphs 99-104. Therefore, although *Choe* discloses determining friction factors for laminar and turbulent flow regimes, the situation in *Choe* is a dissimilar fluid (drilling mud versus gas) in a dissimilar environment (a wellbore-drillstring annulus versus a formation fracture), and therefore *Choe* does not disclose accounting for gas flow in a fracture. *Id.* Applicants submit that the element "non-Darcy factors compris[ing] compensation for turbulent gas flow in a fracture" of claim 15 is not presented in *Roggero* in view of *Wright* and *Choe*, and therefore the prima facie case under 35 U.S.C. § 103(a) is not met in regard to claim 15.

Further, Applicants submit that *Choe* is non-analagous art to the present application. The present application is directed to modeling of gas flow in a fracture. The *Office Action* asserts that *Choe* involves "hydrocarbon well modeling and stimulation," but *Choe* involves an application that explicitly excludes stimulation. *Choe* is directed to drilling and well control operations, including flowing drilling mud in a wellbore-drillstring annulus. In drilling and well control, fracturing of the formation is an undesirable result. Indeed, *Choe* states "the bottom hole pressure *must be maintained below a formation fracture pressure.* If the bottom hole pressure

exceeds the formation fracture pressure, the formation may be damaged or destroyed and the well may collapse around the drill string." *See Choe* paragraph 14, emphasis added. Applicants submit that one of skill in the art would not look to *Choe* to address the problem of modeling gas flow in a fracture.

Because *Choe* is not analogous art, and because the combination of *Roggero* in view of *Wright* and *Choe* does not disclose each element of claim 15, Applicants submit that claim 15 is in a condition for prompt allowance.

Rejection of claims 2-7, 9-13, and 16-18 under 35 U.S.C. § 103(a)

Applicants submit that dependent claims 2-7, 9-13, and 16-18 are allowable for at least the reasons presented previously regarding claim 8.

In summary, for the reasons and amendments detailed above, it is submitted that all claims now presented in the application are in condition for allowance, and accordingly, such action is respectfully requested. Amendments made to the independent claims are applicable to the claims dependent thereon. Applicants submit this paper is fully responsive to the comments in the *Office Action* and respectfully solicit for this application to be granted in light of these amendments and remarks.

If the Examiner believes that the prosecution of the application would be facilitated by a telephone interview, Applicants invite the Examiner to contact the undersigned at 281-285-8606. The Commissioner is hereby authorized to charge any fees that may be required, or credit any overpayment, to Deposit Account No. 04-1579 (56.0753).

Respectfully Submitted,

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